

CLAIMS:

What is claimed is:

1. A method for simulation of light scattering in large three dimensional objects
5 comprising the steps of:
 - a) decomposing the three dimensional object into a plurality of elementary two dimensional objects,
 - b) defining the two dimensional objects by edges of the objects, and
 - c) applying edge domain decomposition for the edges of the two dimensional objects.
- 10 2. The method of claim 1 and further including:
 - d) spectrally mapping the edge domain decomposition.
3. The method of claim 2 wherein the three dimensional object comprised a photo mask
15 with multiple and interconnected openings.
4. The method of claim 3 wherein step c) includes computational methods which speed-up calculations through use of table look-up of previously calculated objects and filtering that sequentially invokes more rigorous simulation as needed.
- 20 5. The method of claim 4 wherein electromagnetic field from the diffraction of isolated edges is recycled in the synthesis of near diffracted field for arbitrary two dimensional diffracting geometries.
- 25 6. The method of claim 5 wherein the scattered field from all edges are summed to simulate light scattering in the two dimensional objects.
7. The method of claim 6 wherein scattered light is polarized and step c) includes separate decomposition for light parallel to edges (TE) and for light perpendicular (TM) to
30 edges.
8. The method of claim 7 wherein step c) includes pre-simulating all distinct edges in the object with all possible illumination directions and field polarizations.

9. The method of claim 8 wherein in step a) the two dimensional objects comprise rectangles.

10. The method of claim 9 wherein the object is a phase shifting mask and step c) of pre-simulating light scattering from edges includes phase effects of etch depths in defining the phase shifting mask.

11. The method of claim 10 wherein the simulation of light scattering is based on through the lens optical spectra.

12. The method of claim 10 wherein the simulation of light scattering is based on a raised cosine function for the optical spectra.

13. The method of claim 10 wherein the simulation of light scattering is based on a Gaussian function for the optical spectra.

14. The method of claim 10 wherein the simulation of light scattering is based on a rect-function for the optical spectra.

15. The method of claim 3 wherein the object is a phase shifting mask and step c) includes pre-simulating light scattering from edges includes phase effects of etch depths in defining the phase shifting mask.

16. The method of claim 15 wherein scattered light is polarized and step c) includes separate decomposition for light parallel to edges (TE) and for light perpendicular (TM) to edges.

17. The method of claim 16 wherein step c) includes pre-simulating all distinct edges in the object with all possible illumination directions and field polarizations.

18. The method of claim 1 wherein step c) includes pre-simulating all distinct edges in the object with all possible illumination directions and field polarizations.

19. The method of claim 1 wherein the scattered field from all edges are summed to simulate light scattering in the two dimensional objects.

20. For use in inspecting photo masks and in optical proximity correction in mask design,

5 a method for simulating light scattering in openings in the mask comprising the steps of:

a) defining openings in the mask by edges,

b) simulating light scattering by the edges, and

c) summing the simulated light scattering by the edges to simulate light scattering in mask openings.

10 21. The method of claim 20 wherein scattered light is polarized and step b) includes separate simulations for light parallel to edges (TE) and for light perpendicular (TM) to edges.

15 22. The method of claim 21 wherein step b) includes pre-simulating all distinct edges in the object with all possible illumination directions and field polarizations.

23. The method of claim 22 wherein the openings in the mask comprise rectangles.

20 24. The method of claim 23 wherein the object is a phase shifting mask and step b) of pre-simulating light scattering from edges includes phase effects of etch depths in defining the phase shifting mask.

25 25. The method of claim 24 wherein any non-defective portion of a mask is identified and light scattering is simulated and a defective portion uses a pre-simulated light scattering from a library for isolated defects, the pre-selected light scattering being combined with the simulated light scattering.

26. The method of claim 25 wherein the combining of light scattering is performed in a
30 space domain by shifting a light scattering field from the defective portion.

27. The method of claim 25 wherein the combining of light scattering is performed in a frequency domain by changing the phase of propagating orders for the defective portion.

28. The method of claim 20 wherein any non-defective portion of a mask is identified and light scattering is simulated and a defective portion uses a pre-simulated light scattering from a library for isolated defects, the pre-selected light scattering being combined with the simulated light scattering.

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29. The method of claim 28 wherein the combining of light scattering is performed in a space domain by shifting a light scattering field from the defective portion.

30. The method of claim 28 wherein the combining of light scattering is performed in a
10 frequency domain by changing the phase of propagating orders for the defective portion.